WHAT IS CLAIMED IS:

1. An automatic shift control apparatus for a manual transmission, comprising:

at least one clutch interposed between an engine and the manual transmission; and

a controller that performs a feedback control for an engagement force of the clutch after the controller ends a gear shift for the manual transmission in such a manner that an input revolution speed of the clutch is directed toward another revolution speed thereof after the gear shift occurs at a predetermined time variation rate, the controller setting mutually different feedback control gains in a variation region of the input revolution speed of the clutch in which the input revolution speed of the clutch is directed toward the other revolution speed after the gear shift occurs and in a convergence region of the input revolution speed in which the input revolution speed of the clutch has reached to the other revolution speed after the gear shift occurs.

2. An automatic shift control apparatus for a manual transmission as claimed in claim 1, wherein the controller comprises a region transfer determining section that determines that a region transfer from the variation region of the input revolution speed of the clutch to the convergence region thereof occurs when both of a condition that the input revolution speed has reached to the other revolution speed after the gear shift occurs and at least one condition that a slip rate of the clutch is

equal to or larger than zero and an effective gear ratio has reached to a gear ratio after the gear shift occurs are established.

3. An automatic shift control apparatus for a manual transmission as claimed in claim 1, wherein the clutch comprises two clutches for each group of gear shift stages, the gear shift stages being divided into two groups, and wherein the controller performs the feedback control for the engagement force for one of the two clutches which is an engagement side clutch when the gear shift occurs in such a manner that a slip rate of the engagement side clutch is made equal to a target slip rate for each engine torque.

4. An automatic shift control apparatus for a manual transmission as claimed in claim 1, wherein the clutch is a single clutch of the manual transmission and the controller performs the feedback control for an engagement force of the clutch in such a manner that an effective gear ratio becomes a target gear ratio.

5. An automatic shift control apparatus for a manual transmission as claimed in claim 3, wherein the controller performs the feedback control for the engagement force of the engagement side clutch in a variation region (AA) of the input revolution speed of the engagement side clutch (C2) in which the controller determines a first engagement ramp gradient (β) for the engagement side clutch in accordance with an engine torque (Te) in the

variation region of the input revolution speed of the engagement side clutch and calculates a slip rate (SLIP) as follows:

SLIP = |(NC1 - Ne)/(NC1 - NC2)|,

wherein Ne denotes an engine speed which corresponds to the input revolution speed of the engagement side clutch (C2), NC1 denotes a revolution speed of the other clutch which is a release side clutch to be inputted to the manual transmission, NC2 denotes a revolution speed of the engagement side clutch to be inputted to the manual transmission, sets a target slip rate **a** (TSLIP), calculates a revolution speed converted value dNe of a deviation (SLIP - TSLIP) of the actual slip rate (SLIP) from the target slip rate (TSLIP), calculates a revolution speed converted value (dNe) of a deviation of the slip rate from the target slip rate as follows:

dNe = (SLIP - TSLIP) x (NC2 - NC1),

determines one of the feedback control gains (TAFB) of the engagement force control for the engagement side clutch (C2) in accordance with engine torque (Te) to approach the deviation on the slip rate to zero, determines a first engagement force control feedback controlled variable (TC2AFB) from the first feedback control gain (TAFB) and the slip rate deviation revolution speed converted value (dNe), raises an engagement force command value (TC2) for the engagement side clutch (C2) by each value (TC2A) which corresponds to the ramp gradient (β) and adds the feedback controlled variable (TC2AFB) to the engagement force command value (TC2) to output the engagement force command value (TC2 = TC2 + TC2A + TC2AFB) to a clutch actuator.

6. An automatic shift control apparatus for a manual transmission as claimed in claim 5, wherein, in the variation region of the input revolution speed of the engagement side clutch, the controller performs a release control for the other clutch which is a release side clutch and the controller determines a release ramp gradient (α) of an engagement force command value (TC1) for the release side clutch in accordance with the engine torque (Te) and lowers the engagement force command value (TC1) of the release side clutch (C1) by each value (TC1B) which corresponds to the ramp gradient (α) of the engagement force command value for the release side clutch (C1), the lowered engagement force command value (TC1) being outputted from the controller to a clutch actuator.

7. An automatic shift control apparatus for a manual transmission as claimed in claim 6, wherein the controller continues the release control for the release side clutch (C1) until an engagement capacity of the release side clutch indicates a complete release capacity.

8. An automatic shift control apparatus for a manual transmission as claimed in claim 7, wherein the controller performs the feedback control for the engagement force for the engagement side clutch in a convergence region of the input revolution speed of the engagement side clutch when an engagement capacity of the release side clutch (C1) indicates a

complete release capacity and when the calculated slip rate is equal to or larger than zero.

9. An automatic shift control apparatus for a manual transmission as claimed in claim 7, wherein the controller performs the feedback control for the engagement force of the engagement side clutch (C2) in the convergence region of the input revolution speed of the engagement side clutch when the input revolution speed of the engagement side clutch which corresponds to an engine speed (Ne) has reached to the other revolution speed of the engagement side clutch which corresponds to a gear ratio after the gear shift occurs.

10. An automatic shift control apparatus for a manual transmission as claimed in claim 9, wherein the controller performs the feedback control for the engagement force of the engagement side clutch (C2) in the convergence region (BB) of the input revolution speed of the engagement side clutch (C2) in which the controller determines a second engagement ramp gradient (γ) for the engagement side clutch in accordance with the engine torque (Te) in the convergence region of the input revolution speed of the engagement side clutch, calculates the slip rate (SLIP) as follows:

$SLIP = |(NC1 - Ne)/(NC1 - NC2)|$,

sets a target slip rate **b** (TSLIP), calculates a revolution speed converted value (dNe) of a deviation (SLIP - TSLIP) of the actual slip rate (SLIP) from the target slip rate (TSLIP), calculates a revolution speed converted value (dNe) of the deviation of the

slip rate (SLIP) from the target slip rate (TSLIP) as follows: dNe = (SLIP - TSLIP) x (NC2 - NC1), determines the other feedback control gain (TBFB) of the engagement force control for the engagement side clutch (C2) in accordance with engine torque (Te) to approach the deviation between the slip rate (SLIP) and the target slip rate (TSLIP) to zero, a value of the other feedback control gain (TBFB) being different from that of the one feedback control gain (TAFB), determines a second engagement force control feedback controlled variable (TC2BFB) from the feedback control gain (TBFB) and the slip rate deviation revolution speed converted value (dNe), raises the engagement force command value (TC2) for the engagement side clutch (C2) by each value (TC2B) which corresponds to the second ramp gradient (γ) and adds the feedback controlled variable (TC2AFB) to the engagement force command value (TC2) to output the engagement force command value (TC2 = TC2 + TC2B + TC2BFB) to the clutch actuator.

11. An automatic shift control apparatus for a manual transmission as claimed in claim 10, wherein the controller carries out the engagement force control for the engagement side clutch (C2) in the convergence region of the input revolution speed of the engagement side clutch until the slip rate (SLIP) of the engagement side clutch is equal to or below a set value (FSLIP) on a final engagement transfer condition and time (t) has reached to a predetermined time point(t3).

12. An automatic shift control apparatus for a manual transmission as claimed in claim 10, wherein the controller carries out the engagement force control for the engagement side clutch (C2) in the convergence region up to a time point (t3) at which the input revolution speed of the engagement side clutch (C2) has converged to the other revolution speed after the gear shift occurs.

13. An automatic shift control apparatus for a manual transmission as claimed in claim 4, wherein the controller determines a release ramp gradient (α) in accordance with an engine torque (Te), lowers an engagement force command value (TC) by each value (TCR) corresponding to the release ramp gradient (α) and outputs a progressively lowering engagement force command value (TC) during a release operation by the release ramp gradient (α) to a clutch actuator in response to a shift change request occurs until an engagement capacity of the clutch indicates a complete release capacity.

14. An automatic shift control apparatus for a manual transmission as claimed in claim 13, wherein, when the controller determines that a shift operation is ended, the controller performs the feedback control for the engagement force of the clutch in which the controller determines a first engagement ramp gradient (β) in the variation region of the input revolution speed of the clutch in accordance with the engine torque (Te), calculates the effective gear ratio (Gr), reads the target gear ratio, calculates a deviation (dGr= Gr - GrT) between the

effective gear ratio (Gr) and the target gear ratio (GrT), sets one of the feedback control gains (TAFB) of the engagement force control, in a variation region (AA) of the input revolution speed of the clutch in accordance with the engine torque (Te) to approach the deviation (dGr) between the effective gear ratio (Gr) and the target gear ratio (GrT) to zero, determines an engagement force feedback controlled variable (TCAFB) from the one feedback control gain (TAFB) and the deviation (dGr) between the effective gear ratio (Gr) and the target gear ratio (GrT), raises an engagement force command value (TC) during the engagement of the clutch by each value (TC1B) corresponding to the first engagement ramp gradient (β) and adds the feedback controlled variable (TCAFB) to the engagement force command value (TC) to output the added engagement force command value (TC = TC + TC1B + TCAFB) to the clutch actuator.

15. An automatic shift control apparatus for a manual transmission as claimed in claim 14, wherein the controller performs, in the variation region of the input revolution speed of the clutch, the feedback control for the engagement force of the clutch until the effective gear ratio (Gr) has reached to a gear shift ratio (GrAft) after the gear shift occurs.

16. An automatic shift control apparatus for a manual transmission as claimed in claim 15, wherein, when the controller determines a second engagement ramp gradient (γ) in the convergence region of the

input revolution speed of the clutch which corresponds to an engine speed (Ne) in accordance with the engine torque (Te), reads the target gear ratio d (GrT), calculates the deviation (dGr) between the effective gear ratio (Gr) and the target gear shift ratio (GrT), sets the other feedback control gain (TBFB) for the engagement force control of the clutch to approach the deviation (dGr) in the convergence region (BB) of the input revolution speed to zero, a value of the second feedback control gain (TBFB) being different from that of the first feedback control gain (TAFB), raises the engagement force command value (TC) during the engagement of the clutch by each value (TC2B) corresponding to the second ramp gradient (γ), and outputs the engagement force command value (TC) at the second engagement ramp gradient (γ), and outputs the engagement force command value (TC) by the second engagement ramp gradient (γ) to approach the deviation (dGr) between the effective gear ratio (Gr) and the target gear ratio (GrT) to zero.

17. An automatic shift control apparatus for a manual transmission as claimed in claim 16, wherein the controller carries out the feedback control for the engagement force of the clutch in the convergence region of the input revolution speed until the effective gear ratio (Gr) is equal to or less than a set value (Grfin) for a final engagement transfer condition and the time has reached to a time point (t3) at which the engine speed (Ne) has reached to the other revolution speed of the clutch which

corresponds to the gear ratio after the gear shift occurs.

18. An automatic shift control apparatus for a manual transmission as claimed in claim 16, wherein the effective gear ratio (Gr) is represented by a ratio between input and output revolution speeds (Ne, No) of the manual transmission and the target gear ratios (GrT) in both of the variation and convergence regions of the input revolution speed of the clutch are arbitrarily set.

19. An automatic shift control apparatus for a manual transmission, comprising:

clutch means interposed between an engine and the manual transmission; and

controlling means that performs a feedback control for an engagement force of the clutch means after the controller ends a gear shift for the manual transmission in such a manner that an input revolution speed of the clutch means is directed toward another revolution speed thereof after the gear shift occurs at a predetermined time variation rate, the controlling means setting mutually different feedback control gains in a variation region of the input revolution speed of the clutch means in which the input revolution speed of the clutch means is directed toward the other revolution speed after the gear shift occurs and in a convergence region of the input revolution speed in which the input revolution speed of the clutch has reached to the other revolution speed after the gear shift occurs.

20. An automatic shift control method for a manual transmission, comprising:

providing at least one clutch interposed between an engine and the manual transmission; performing a feedback control for an engagement force of the clutch after a gear shift for the manual transmission is ended in such a manner that an input revolution speed of the clutch is directed toward another revolution speed thereof after the gear shift occurs at a predetermined time variation rate; and, while performing the feedback control for the engagement force of the clutch, setting mutually different feedback control gains in a variation region of the input revolution speed of the clutch in which the input revolution speed of the clutch is directed toward the other revolution speed after the gear shift occurs and in a convergence region of the input revolution speed in which the input revolution speed of the clutch has reached to the other revolution speed after the gear shift occurs.